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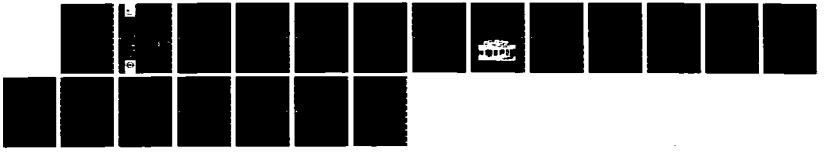

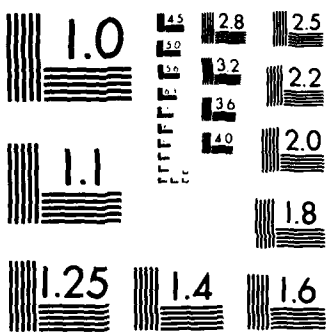

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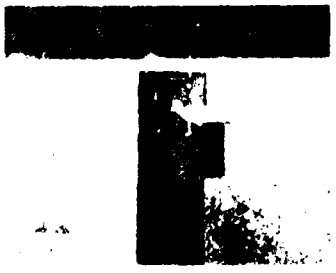

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TECHNICAL REPORT EL-86-18

ELEVATED QUAIL ROOSTS

Section 5.1.5, US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL

by

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A management techniques report on elevated quail roosts is provided as Section 5.1.5 of the US Army Corps of Engineers Wildlife Resources Management Manual. The report was prepared as a guide to assist Corps biologists and resource managers in developing roosting habitat for quail in the western states. Topics covered for elevated roosts include design, construction, installation, placement, maintenance, personnel and costs, cautions and limitations, and evaluation.

The development of artificial roosting structures for use by the California quail (*Callipepla californica*) and Gambel's quail (*C. gambelii*) is described in this report. The structure given primary consideration is a wooden crib elevated on wooden posts and filled with brush. Detailed construction and assembly details, including specification drawings and lists of materials, are provided. Guidelines for placement of quail roosts based on roosting requirements and other habitat needs of target species are given, and appropriate cautions and limitations are discussed.

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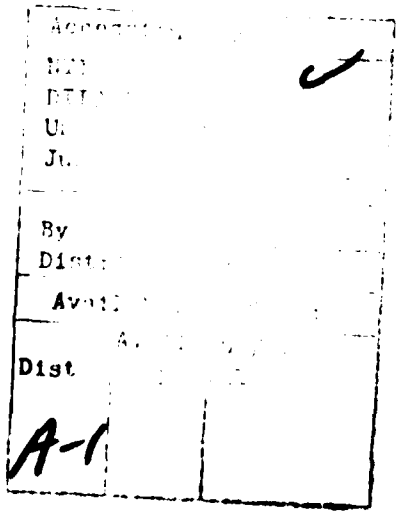

PREFACE

This work was sponsored by the Office, Chief of Engineers (OCE), US Army, as part of the Environmental Impact Research Program (EIRP), Work Unit 31631, entitled Management of Corps Lands for Wildlife Resource Improvement. The Technical Monitors for the study were Dr. John Bushman and Mr. Earl Eiker, OCE, and Mr. Dave Mathis, Water Resources Support Center.

This report was prepared for the US Army Engineer Waterways Experiment Station (WES) by Mr. James R. Kosciuk, Dworshak Project, US Army Engineer (USAE) District, Walla Walla, Walla Walla, Wash., and Mr. E. Paul Peloquin, USAE Division, North Pacific, Portland, Oreg. Mr. Chester O. Martin, Team Leader, Wildlife Resources Team, Wetlands and Terrestrial Habitat Group (WTHG), Environmental Laboratory (EL), WES, was principal investigator for the work unit. Ms. Ruth A. (Wilson) Jacobs, USAE District, Portland, Portland, Oreg., conducted a literature survey on the roosting requirements for western quail that provided background information for the report. Design specifications for the wooden crib were originally prepared by the USAE District, Walla Walla, for the Lower Snake River Project. Review and comments were provided by Mr. Martin and Dr. Wilma A. Mitchell, WTHG.

The report was prepared under the general supervision of Dr. Hanley K. Smith, Chief, WTHG, EL; Dr. Conrad J. Kirby, Chief, Environmental Resources Division, EL; and Dr. John Harrison, Chief, EL. Dr. Roger T. Saucier, WES, was Program Manager, EIRP. The report was edited by Ms. Jessica S. Ruff of the WES Publications and Graphic Arts Division (PGAD). Drawings were prepared by Mr. John R. Harris, Scientific Illustrations Section, PGAD, under the supervision of Mr. Aubrey W. Stephens, Jr.

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NOTE TO READER

This report is designated as Section 5.1.5 in Chapter 5 -- MANAGEMENT PRACTICES AND TECHNIQUES, Part 5.1 -- NESTING AND ROOSTING STRUCTURES, of the US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL. Each section of the manual is published as a separate Technical Report but is designed for use as a unit of the manual. For best retrieval, this report should be filed according to section number within Chapter 5.

ELEVATED QUAIL ROOSTS

Section 5.1.5, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

The absence of suitable roost sites is often considered a limiting factor to populations of western quail. For example, Emlen and Glading (1945) postulated that roost sites were limiting to California quail (*Callipepla californica*) on nonbrushy rangelands, pasture, and farmland in California, and Goodwin and Hungerford (1977) found that the number of suitable roosts affected populations of Gambel's quail (*C. gambelii*) in Arizona. These species roost above ground at night in trees, shrubs, and even cacti. Both evergreen and deciduous vegetation are used if foliage or branches are dense and high enough to provide concealment from ground and aerial predators (Sumner 1935, Leopold 1977). California quail roost at heights from 5 to 30 ft (Emlen and Glading 1945), and Gambel's quail generally roost in shrubs from 7 to 17 ft high (Goodwin and Hungerford 1977).

Permanent roosting habitat for California and Gambel's quail is best established with plantings of thickly foliaged trees or shrubs such as junipers (*Juniperus* spp.) and live oaks (*Quercus* spp.) (Leopold 1977). However, when nocturnal roosting cover is needed immediately or when plantings are difficult to establish, artificial cover can be provided by constructing elevated brush piles (MacGregor 1950, McMillan 1959). These roosts may also be used by quail and other birds during the day and may be a valuable source of shade for large and small mammals inhabiting arid regions.

The development of artificial roosting structures for use by California and Gambel's quail is described in this account. The structure given primary

consideration is a wooden crib elevated on wooden posts and filled with brush (Fig. 1). The crib has been used by the U.S. Army Engineer District (USAED), Walla Walla, as part of a wildlife habitat mitigation program along the Snake River in southeastern Washington.

DESIGN, CONSTRUCTION, AND INSTALLATION

Any system of frame and supports that will hold brush above ground at a desired elevation for a given period of time can serve as an artificial roost. The designs discussed here can be readily modified to suit specific site or species requirements and availability of materials.

Wooden Crib

The wooden crib design consists of a rectangular wooden frame elevated approximately 6 ft above ground on 4 posts. A series of 2- × 4-in. boards span the width of the interior of the crib, and wire mesh serves as the crib

Figure 1. Elevated quail roosts installed along the Snake River in southeastern Washington

floor. Brush piled into the crib is supported by the boards and wire floor. The structure is durable and especially suited for situations where a relatively permanent structure is required. Materials needed for contruction are listed in Table 1. Step-by-step construction and assembly details are shown in Figures 2-5 and described below. Except for cutting the lumber to sizes indicated in Table 1, all construction occurs at the installation site.

Step 1. Mark positions and dig holes for posts. Posts must be aligned so the 8- and 16-ft lengths of 2- × 8-in. lumber can be joined to the posts to form a rectangular frame 16 ft long and about 8 ft wide (Fig. 2). Pieces of lumber can be used to judge proper spacing of posts. Post holes should be approximately 3 ft deep. Position the 6- × 6-in. posts in the holes, and adjust hole depths or trim tops so that all posts are level. Backfill soil around the posts and compact by tamping.

Step 2. Construct sides of the crib. First frame the crib bottom by bolting the 8- and 16-ft lengths of the 2- × 8-in. lumber on the outside of the posts using connection A (Figs. 2 and 3). The bottom of the frame should be 3 ft from the top of the posts and approximately 6 ft from the ground. Using the same connection, bolt three 2- × 4-in. pieces of lumber to each side

Table 1. Materials needed to construct a wooden crib quail roost

Item	Quantity
Lumber	
2 × 8 in. × 8 ft	3
2 × 8 in. × 16 ft	2
2 × 4 in. × 8 ft	13
2 × 4 in. × 16 ft	6
1 × 4 in. × 9 ft	12
6 × 6 in. × 12 ft	6
Hardware	
Nails, 6d galvanized	5 lb
Carriage bolt, cad plated 3/8 × 8 in. (with nut)	32
Flat washer, 3/8 × 2 in.	32
Lag bolt, cad plated, 3/8 × 4 in.	32
Galvanized fence staples, 1-1/4 in.	48
Wire mesh, 6 × 6 in. (W 1.4 × 1.4),* available in 7-ft width	27

* W = Welded wire fabric; 1.4 × 1.4 = diameter of wire in millimeters.

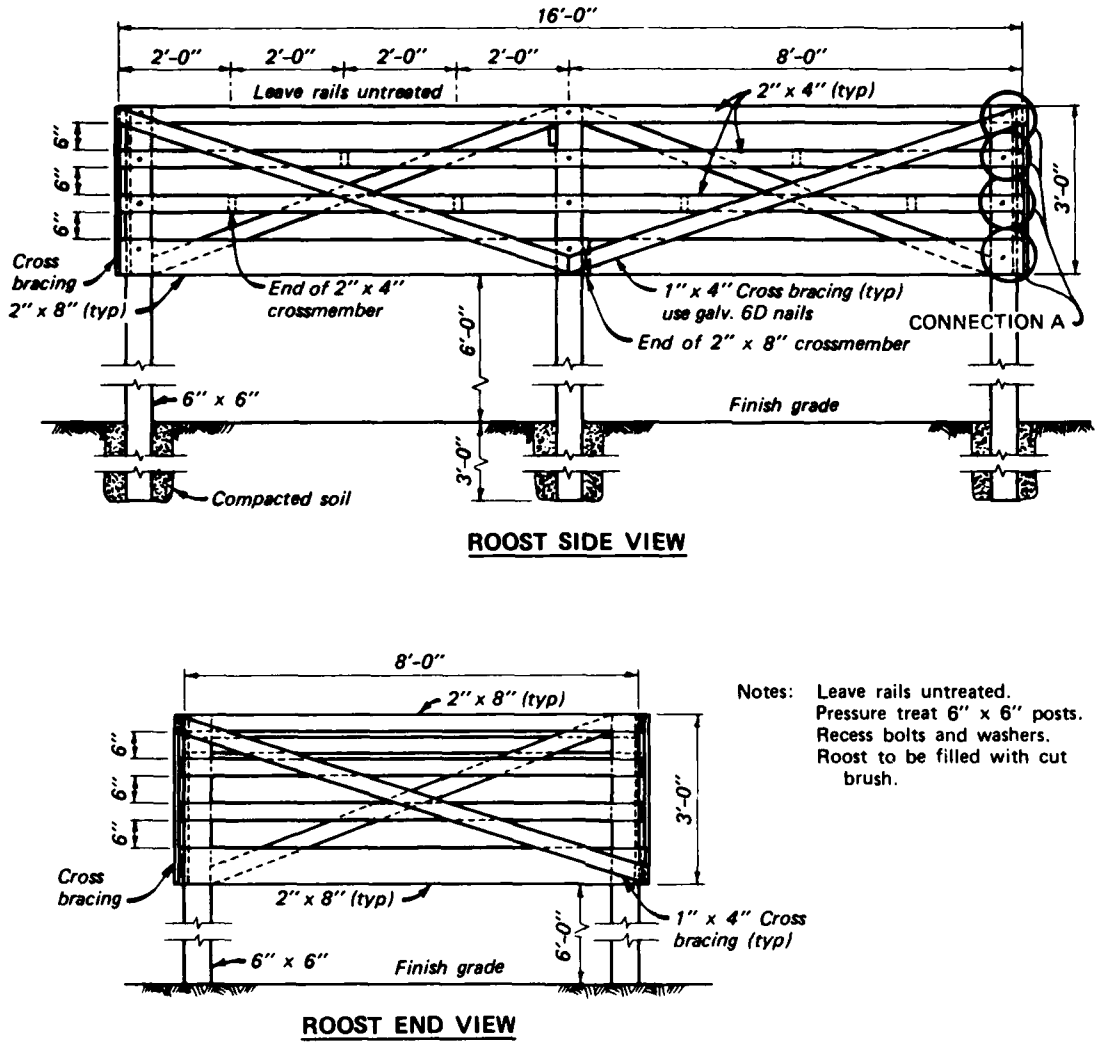


Figure 2. Construction and assembly details for elevated quail roost (after USACE 1979)

to form the side rails of the crib. A 6-in. space should separate the bottom of each rail from the top of the adjacent rail. Recess the bolts and washers where they interfere with placement of exterior cross bracings.

Step 3. Cut and attach cross bracings to crib. Measure the length of each diagonal exactly, and cut a cross bracing from the 1- × 4-in. lumber to fit each diagonal length (Fig. 2). One bracing should be on the outside and

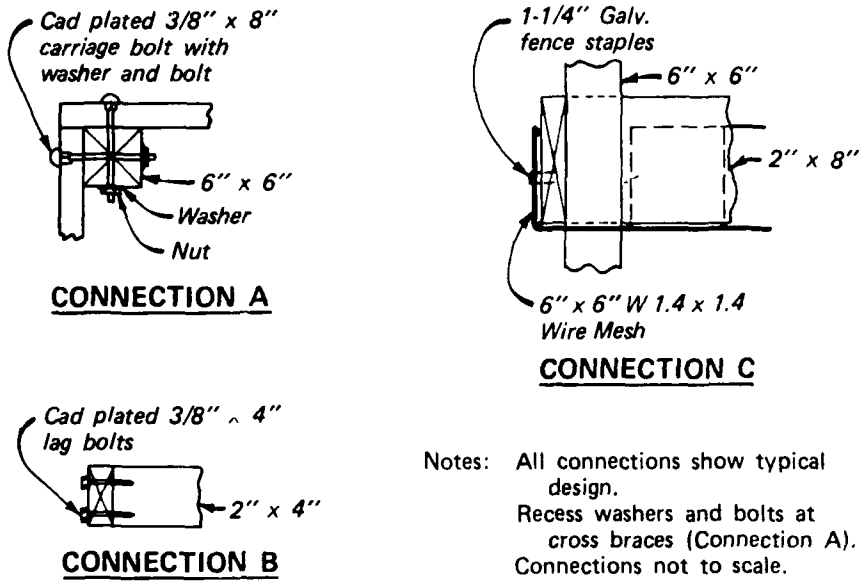


Figure 3. Connections used to attach 2- × 4-in. lumber to posts (Connection A), to attach 2- × 4-in. crossmembers to crib (B), and to staple wire floor to sides of crib (C) (from USACE 1979).

one on the inside of the rails; on long sides, exterior bracings should adjoin each other at the center posts. All bracings on the crib interior should meet (not overlap) edges of the posts. Nail cross bracings to posts using 6d galvanized nails.

Step 4. Attach wire mesh floor to crib. Wire mesh with 6- × 6-in. openings is available only in 7-ft widths. Therefore, the first procedure is to cut a 27-ft-long × 7-ft-wide piece of wire mesh into two 7- × 9-ft sections and one 2-ft, 8-in. × 9-ft section (Fig. 4). Turn up a 6-in. edge on all 7-ft sides of the mesh, on the two 2-ft, 8-in. sides, and on 2 of the 9-ft sides. Place the sections of wire mesh inside the bottom frame of the crib to form the floor (Figs. 4 and 5). Cut out pieces of mesh to fit the floor around the support posts. Edges of the mesh that are not turned up should meet. Staple turned-up edges to inside of the bottom frame with galvanized fence staples (Connection C, Figs. 3 and 5).

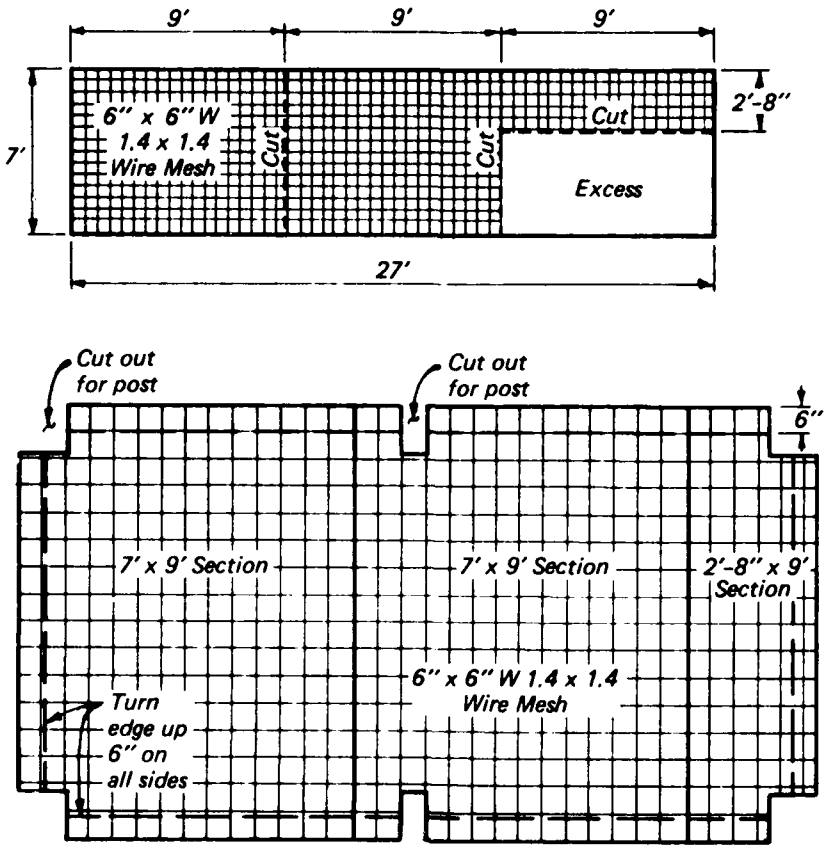
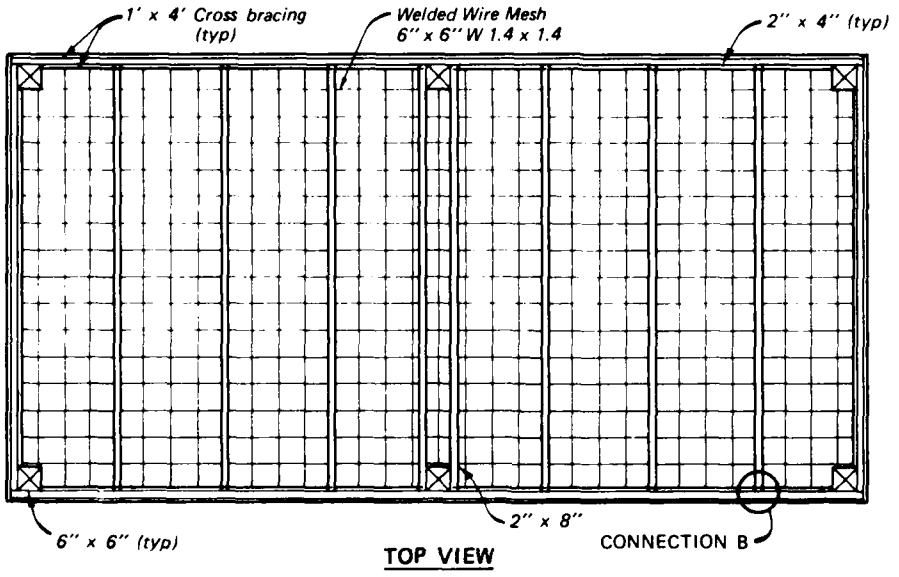
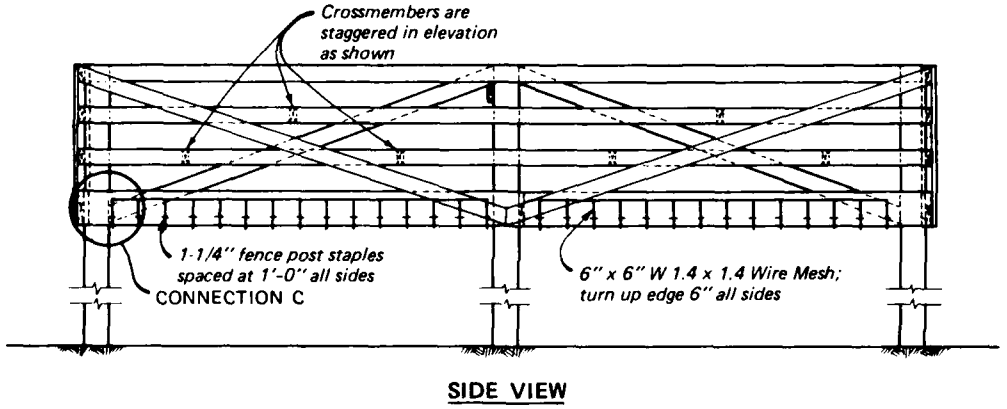


Figure 4. Details for cutting the wire mesh (top) and laying out dimensions for the floor of a wooden crib (bottom)

Step 5. Attach crossmembers to inside of the crib. Use lag bolts (Connection B, Fig. 3) to attach one 2- × 8-in. and three 2- × 4-in. crossmembers between longer sides of the crib. Position crossmembers at staggered intervals as shown in Figure 5. Crossmembers provide space between layers of brush and prevent collapse of brush over time.

Step 6. Pile brush into the crib. Brush should be dense but not packed, and large, heavy branches should support lighter branches. Tree and shrub trimmings collected from managed recreation areas are suitable materials. As a safety measure, inspect the roost and remove any sharp branches that protrude from the sides or bottom of the crib. Bend all pointed and exposed edges of wire or nails into the wooden frame.





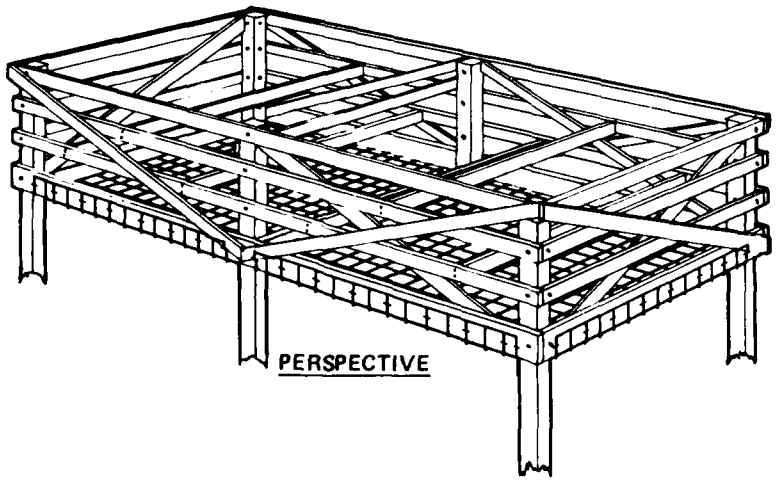


Figure 5. Roost plan, showing top view of wire mesh floor, side view of frame, and perspective of the completed roost (after USACE 1979)

Pipe Stand

An elevated quail roost made of 2-in. iron pipe and hog-wire fencing has been used by the California Department of Fish and Game (MacGregor 1950). The roost consists of an 8- × 16-ft rectangular pipe frame supported by 4 upright pipes set into the ground (Fig. 6). Wire attached to the top of the frame provides support for brush. Materials required are listed in Table 2. The following guidelines are given for constructing a pipe stand roost. Procedures follow those of MacGregor (1950).

Step 1. The support consists of four 8-ft lengths of 2-in. pipe. Heat, flatten, and bend the ends of the pipes at right angles (Fig. 6). Then drill a 1/2-in. hole in the flattened portions for attachment of the frame. Dig post holes at corners of an 8- × 16-ft rectangle, and set legs 18 in. deep in concrete.

Step 2. Construct frame for the roost. The frame consists of two 8-ft and two 16-ft lengths of 2-in. pipe. Flatten both ends of each pipe and drill 1/2-in. holes in the flattened portions. Fasten the frame together and to the legs with a 3/8-in. bolt at each corner. Use 2 flat washers with each bolt.

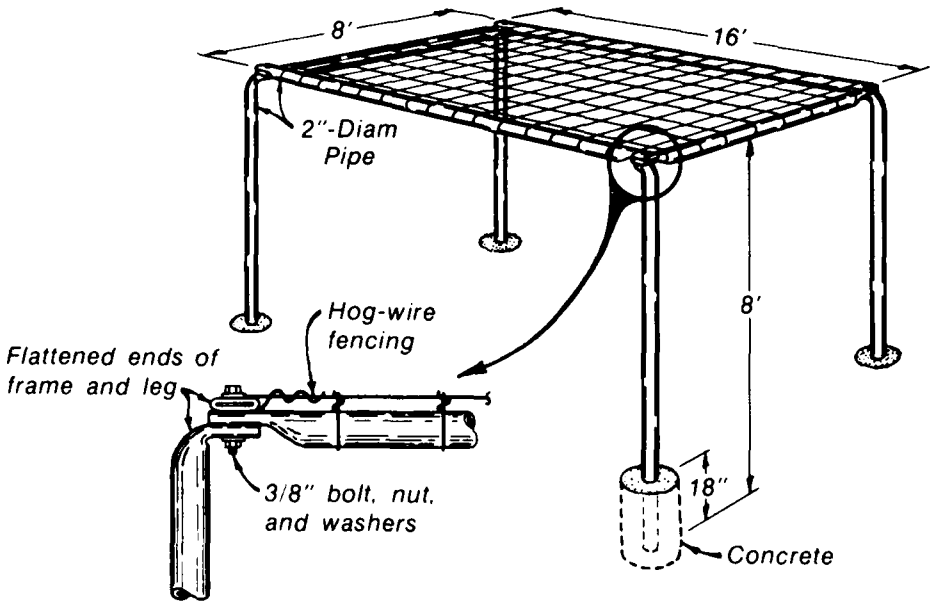


Figure 6. Construction and assembly details for pipe roost (after MacGregor 1950)

Table 2. Materials needed to construct a pipe stand roost (after MacGregor 1950)

Item	Quantity
Iron pipe, 2-in. diameter	
8-ft length	6
16-ft length	2
Hardware, galvanized	
Bolt, 3/8 × 3 in. (with nut)	4
Flat washer, 3/8 × 5/8 in.	4
Lock washer, 3/8 in.	4
Wire mesh (variable mesh size)	153 sq ft
Cement	1/4 cu yd (approx.)

Step 3. Fasten wire mesh or a similar material to the frame. Pile brush on top of the wire-covered frame. The brush should consist of crooked limbs of juniper, oak, or other suitable vegetation; do not use straight-limbed species that pack down easily (MacGregor 1950). Roosts should have exterior openings from 3-1/2 to 4 in. for access by quail, and spacings of at least 5 in. should be provided for roosting in the interior of the structure (McMillan 1959).

Other Designs

Leopold (1977) suggested (1) stretching 2 parallel cables across a gully to support a brush pile or (2) stacking brush in the crown of a living tree to increase the density of existing cover. Deciduous species that lose their suitability for roost sites when foliage becomes sparse may be improved by piling cut limbs in forks of the tree to provide a dense, persistent cover (MacGregor 1950). Wooden crib and pipe stand roosts may be modified by using wire or cable stretched across the frames rather than wire mesh.

McMillan (1959) provided specifications for a wooden frame structure mounted on a pipe support. The frame is constructed of 2- × 4-in. and 1- × 3-in. pieces of lumber spaced 4 in. apart and nailed solidly together. The completed structure is 6 ft long, 3 ft wide, and 2 ft deep. The pipe support consists of four pieces of 2-in.-diam pipe welded perpendicularly to a 3-in.-diam pipe 11 ft long. The 3-in.-diam pipe is set 4-1/2 ft into the ground. Hog wire is stretched across the bottom of the wooden frame, and it is then

wired to the top of the pipe support. Illustrations for this roost design are provided in McMillan (1959) and Yoakum et al. (1980).

PLACEMENT

The placement of quail roosts should be determined by the roosting requirements and other habitat needs of the target species. The proper interspersion of food, cover, and water should be major considerations. Quail roosts have been installed in conjunction with gallinaceous guzzlers and food and cover plantings at several management units in the USAED, Walla Walla (USACE 1979). For practical purposes roosts should not be placed in deep, narrow gullies or in areas exposed to strong winds.

The home range of a covey of California quail many vary from 17 to 45 acres during the winter months (Emlen 1939). Therefore, at least 1 good roost site should generally be available for every 30 to 40 acres of habitat (Emlen and Glading 1945, Yoakum et al. 1980). It may be beneficial to provide 2 roosts approximately 150 ft apart within each covey's range so that birds flushed from 1 roost can move readily to another (MacGregor 1950). Roosts for California quail should be within 48 ft of brushy cover (Emlen and Glading 1945) and within 1/2 mile of open water (MacGregor 1950, Edminster 1954) if quail using the roosts depend on open water rather than succulent foods to meet their needs.

Gambel's quail rarely move more than 150 to 300 ft from dense escape cover (Goodwin and Hungerford 1977), and roosts should be located within this range of brushy cover. Most coveys are known to remain within 1 mile of a water source when open water is a habitat requirement (Johnsgard 1973); therefore, roosts should be located within this distance of water when succulent foods are not available during critical periods. Little information is available on the effect of elevated roosting structures on populations of Gambel's quail. Therefore, area game bird specialists should be consulted regarding cover requirements at a specific locality.

MAINTENANCE

An artificial roost is usually provided only for temporary cover before vegetation achieves appropriate branch and foliage development. However, a roost should be checked annually and repaired as needed. McMillan (1959)

emphasized the importance of maintaining the proper density, arrangement, and bulk of brushy material used in quail roosts. He found that in some cases the green, brushy roost material had a tendency to deteriorate and settle into compact mats within a few years. Thus, roosts should be checked periodically to ensure that the proper density and spacing is maintained.

PERSONNEL AND COSTS

The list of materials in Tables 1 and 2 can be used to calculate costs of roosts based on current prices. Cost of materials for the wooden crib used by the USAED, Walla Walla, in 1979 was approximately $225 per roost (USACE 1979). Approximately 1 hour is required to measure and cut lumber for the wooden roost. Two people working 2 hours each are needed for construction. One person should be able to construct and install the pipe structure in less than 4 hours. Time required to fill either roost with brush will depend on availability of materials. Travel time to and from sites must also be considered.

CAUTIONS AND LIMITATIONS

Quail prefer live vegetation for roosting cover and may roost in marginal brush even though an artificial roost is provided. Therefore, the decision to construct artificial roosts should be made on a site-specific basis after fully evaluating the habitat components present. Artificial roosts should generally be considered as temporary structures developed to provide instant cover, and attempts should be made to provide natural roost sites through plantings and habitat management.

The wooden crib design is extremely sturdy and durable but may be too elaborate to meet certain needs. The specifications given in Figures 2-5 may be scaled down for the construction of smaller roosts. Proper placement of elevated roosts is of major importance. As previously discussed, roosts should not be located in deep, narrow gullies or at sites exposed to high winds.

EVALUATION

The level of use that a roost receives can be documented seasonally by counting the number of quail entering a roost at dusk or departing at dawn. To document average and maximum levels of use, repeated observations should be made through fall and winter months because coveys tend to band and disband or

shift use among portions of their range (Gorsuch 1934, Emlen 1939). Average or maximum use by other species of birds can be documented in a similar manner, with observations corresponding to diurnal or seasonal periods of use. Comparisons of changes in population levels on managed and control areas over time is recommended for assessing the value of artificial roosts. Standard censusing techniques such as drive or flush counts should be adequate for making comparisons.

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